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PRELIMINARY TECHNICAL DESCRIPTION
of
ZOOM MAGNIFIER IMPROVED DESIGN

1.0 INTRODUCTION

The Zoom Magnifier described here is an improved version of the originally designed and fabricated instrument. Three major improvements are: an increase in zoom range from 7X to 18X, an increase in field size throughout the zoom range and an increase in image quality over the entire field of view. These improvements have been incorporated after extensive optical design. Several changes have resulted due to this revised design. Two of the changes are: 1) The instrument height has increased about 20mm to 106mm, and 2) the distortion of the system has increased by 1.6% at 8X but for the enlarged field of 16.3mm. It may be seen that any change to the original instrument results in trade off considerations which must be carefully considered to determine optimum performance. The Magnifier as described below is felt to be the best design compromise.

2.0 OPTICAL SYSTEM

A mechanical layout of the Zoom Magnifier is shown in Fig. 1. The optical system is seen to consist of three sets of doublets and two cemented triplets. The doublets

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make up the zoom portion of the system with the upper two doublets moving and the third doublet fixed. The two cemented triplets present collimated light to the zoom system. The magnification range of the instrument is continuously variable from $\overset{0}{(8X)}$ to 18X. The predicted field size will be 16.3mm at 8X and 5.5mm at 18X with the field size and magnification varying in an inverse manner as shown by the values in the table. The predicted axial resolution of the system is six lines per mm per power. The maximum distortion of the system is calculated to be -5.3% at 8X.

The values presented in the previous paragraph are calculated values and thus should be considered as design goals. Comparison of the predicted and realized values for the first Zoom Magnifier has shown good correlation with some parameters exceeding the design goal and others falling below the design goal.

3.0 MECHANICAL SYSTEM

Reference should, again, be made to Fig. 1. Three knurls are illustrated. The center knurl is the gripping knurl and is held stationary for both the focusing and zooming operations. Focusing is accomplished by rotating the lower knurl. Zooming is performed by rotating the upper knurl.

The maximum height of the Magnifier will be about 106mm and it will weigh approximately 9.8 ounces. The working distance will be 12.3mm at the nominal focus position. Illumination will be provided through a clear plastic sleeve for situations where opaque objects are viewed. (The magnifier will accept standard reticle sizes but with a special mount).

The comparisons between the original instrument and the improved version are summarized and shown in Table 1.

ZOOM MAGNIFIER

		<u>Original Instrument</u>		<u>Improved Design</u>	
Field of View at	8X	14.0mm		16.3mm	
	13X	6.6mm		12.0mm	
	18X	3.8mm		5.5mm	
Axial Resolution at	8X	218 λ /mm	Empirical	218 λ /mm	Predicted
	18X	403 λ /mm	Data	400 λ /mm	Data
Maximum Height		87mm		106mm	
Image Quality	8X	Good to .7 Zone, Poor .7 Full Field		Good to .9 Zone, Fair .9 Full Field	
	13X	Good throughout Field		"	
	18X	Good " "		"	
Distortion	8X	-3.7%		-5.3%	
	13X	-3.0%	At Full Field	-4.4%	At Full Field
	18X	-1.6%		+0.2%	
Weight		6 ounces		9.8 ounces	

TABLE 1 - COMPARISON OF ORIGINAL DESIGN PARAMETERS WITH IMPROVED DESIGN PARAMETERS